Technology & Background:

As aircraft approach passenger terminals or enter crowded parking aprons pilots receive specific guidance for positioning their aircraft from ground handlers using well defined hand movements. This system of communication is also used on the busy, crowded high tempo flight decks of our nation's aircraft carriers. As the U.S. Navy prepares to integrate unmanned air vehicles (UAVs) into the mix of aircraft typically found on a carrier, it requires a system of communication that integrates easily into this existing operational environment. The system needs to provide for near real time response with little or no lag in control. To accomplish this, the signal processing must be simple and require little computer processing. The system must also be inexpensive, foolproof and be able to operate in harsh weather and electromagnetic environments. The Navy has developed such a system that interprets the standardized visual cues from an aircraft handler and provides an output that can be used by the UAV's onboard computer to move the vehicle as directed by the ground handler. This technology can be easily adopted by other devices or systems where visual communication is desired such as robots, machinery or gaming devices.

Technology Solution:

Many previous attempts at developing a system for gesture recognition utilize video image processing techniques that rely on pixel by pixel-by pixel processing. Assuming a simple 300 by 400 pixel camera would have to analyze 1,200,000 numbers per each incoming frame.

To build a history of motion using only a 3 frame buffer one would have to process almost 4 million numbers. If the frames are incoming at 30 frames a second the processing power required to recognize even a simple hand motion would be significant.

The Navy has developed a system that utilizes only 8 numbers a frame to minimize the computational power required to interpret camera acquired hand/body gesturing commands. Four light markers, which emit a well defined wavelength of light, are positioned on the head, the torso and on each hand of the aircraft handler. Inexpensive, readily available, dependable 740 nm IR LEDs were used on the prototype unit. By utilizing optical filters on the camera lens that only pass light of the wavelength emitted from the LEDs, positions of only four points are identified for each frame of video collected translating into only 8 numbers/frames, the X and Y coordinates of each point. Some commands are defined by dynamic motions of the hands and body. To interpret these signals, approximately 13 video frames are required for analysis translating into an overall collection of a little over 100 numbers per second. This number set is extremely low compared to other techniques. The motion analysis algorithms developed for this system also take into account common image analysis problems associated with the rotation, translation and shift of the human signaler with respect to the camera. A proof of principle has been established with a working laboratory prototype and a significant amount of test data has been obtained.

Summary of Benefits:

- Easily manufactured from low-cost, readily available components
- Integrates smoothly into the existing environment for aircraft handling
- Greatly reduces the processing power required for gesture recognition
- Provides near real-time output to for device control
- Adaptable to other applications without difficulty
- System vocabulary easily expandable

Market Opportunities:

Unmanned vehicles are rapidly gaining acceptance in military, law enforcement and urban search and rescue environments. This technology allows direct human control of these devices under day and night line-of-site conditions without encumbering the controller with a joy stick or other device. The Japan Robotics Association predicts the 2025 worldwide robotic market at $20B.

Another market for this hand gesture technology would be the video and computer gaming industry. The market for this industry is huge and growing at a rapid pace. It is reported that the more sophisticated games that target teens and adult is the fastest growing segment of the industry. The gaming industry projects the worldwide market at $44B.
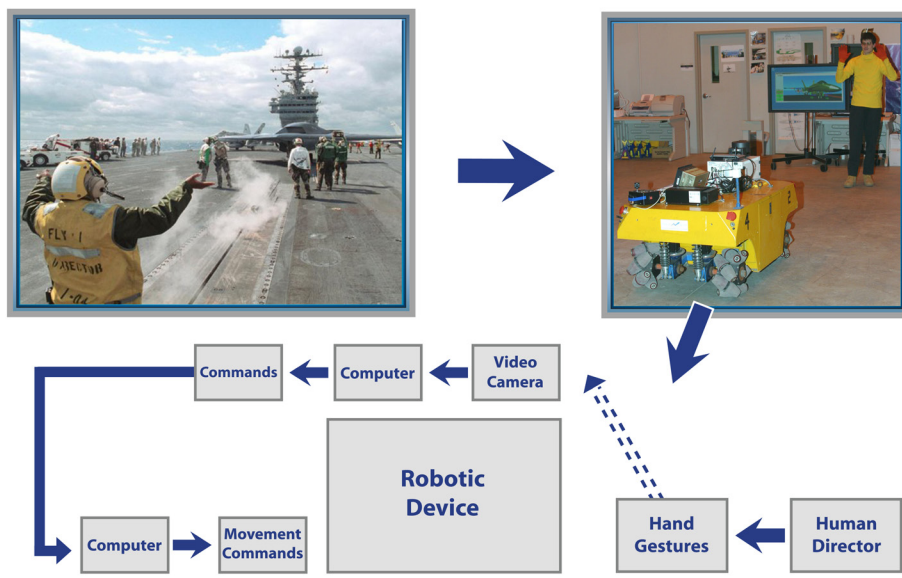
Status and Opportunity:

1.) Full text copy of the issued US patent is available at www.uspto.gov